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APOLLO/SATURN V
FLIGHT SAFETY PLAN
VEHICLE AS-501

GPO PRICE $ _____

CFSTI PRICE(S) $ _____

Hard copy (HC) 3.00

Microfiche (MF) _____

ff 653 July 65

KSC FORM 16-12 (4/66)

K-V-05.13/1

APOLLO/SATURN V
FLIGHT SAFETY PLAN
VEHICLE AS-501

SEPTEMBER 1, 1967

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055-39-0001

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SECTION I
INTRODUCTION

1.1 PURPOSE

This Flight Safety Plan presents flight safety requirements, restrictions, and instrumentation necessary for each launch. The plan defines flight safety responsibilities of the Air Force Eastern Test Range (AFETR) and Kennedy Space Center (KSC). The requirements for flight termination and propellant dispersion are described, and the restrictions and instrumentation applicable for each Apollo/Saturn V flight are listed.

1.2 AUTHORITY

The Flight Safety Plan is authorized within KSC by the Apollo Test Requirements Document, M-D MA 1400, dated May 20, 1964.

1.3 SCOPE

This plan is applicable during the launch countdown and powered flight of the vehicle up to orbit insertion.

SECTION II
FLIGHT SAFETY RESPONSIBILITIES

2.1 AIR FORCE EASTERN TEST RANGE

The Webb-McNamara agreement of January 17, 1963, supplemented by the AFMTC/LOC agreements of June 5, 1963, places the responsibility for flight safety of all launches from the AFETR and KSC on the Commander of the AFETR. This responsibility includes specifying flight termination system requirements, protecting life and property from an errant vehicle (except within KSC), establishing data requirements and flight safety instrumentation requirements, etc.

2.2 KENNEDY SPACE CENTER

By the same agreements cited in paragraph 2.1, the Director, KSC, is responsible for the protection of life and property within KSC from an errant vehicle launched or intended to be launched from Cape Kennedy or KSC. This responsibility includes designating launch danger areas within KSC, clearing these areas during danger periods, etc. Also included is the responsibility for Crew Safety on manned launches from KSC. This responsibility does not include Range Safety Flight Termination control of the vehicle after lift-off, which is the sole responsibility of the Commander of the AFETR. To that extent, the protection of life and property within KSC is a joint effort of KSC and AFETR.

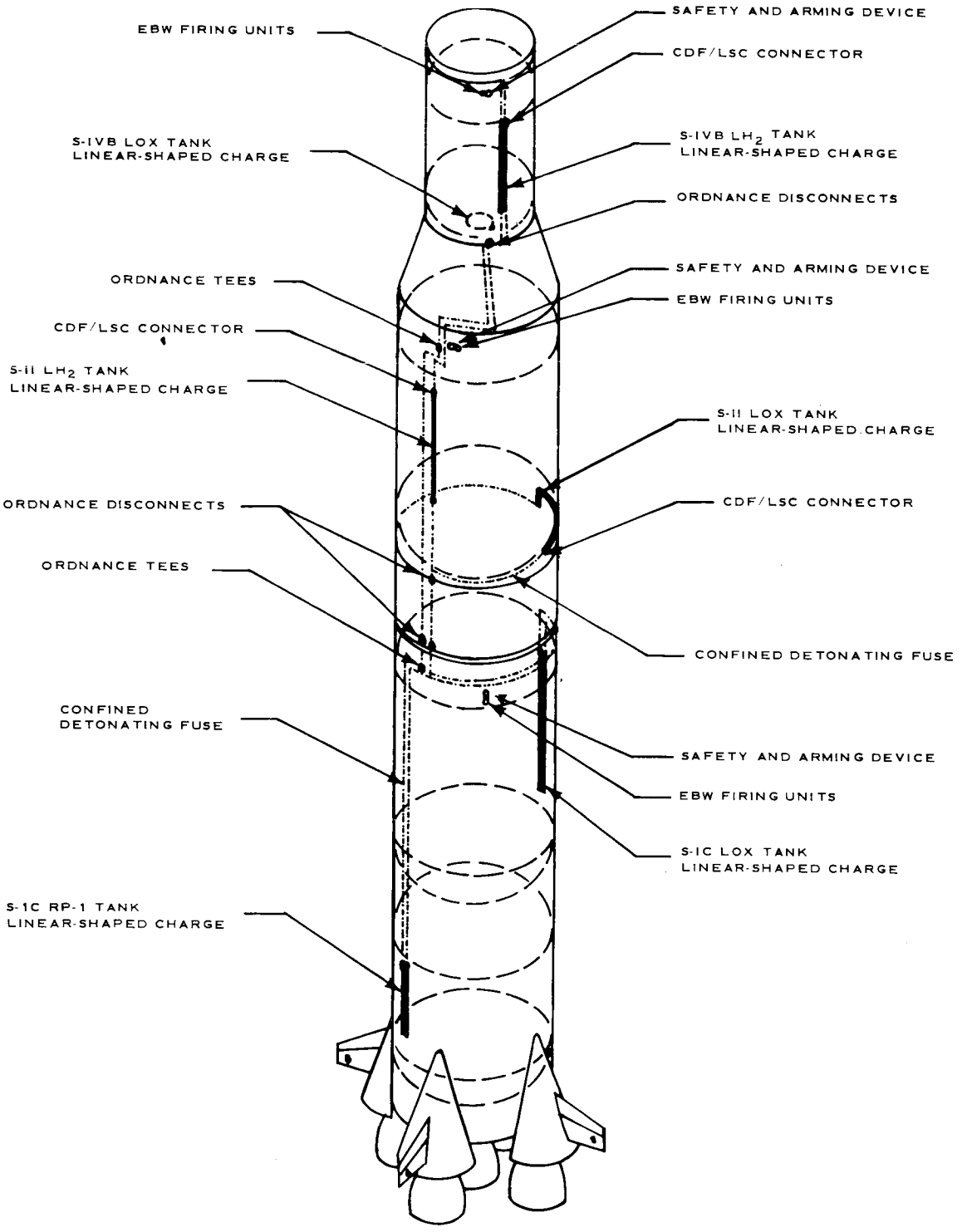

Figure 3-1. Saturn V Propellant Dispersion Ordnance Locations

SECTION III
FLIGHT SAFETY REQUIREMENTS

3.1 FLIGHT TERMINATION SYSTEMS

All ballistic or space booster vehicles launched at the AFETR must contain two independent flight termination systems which are compatible with the AFETR ground system. The two systems must be installed on the last powered stage and must be capable of destroying all powered stages of the vehicles. For stages that go into orbit prior to ignition, a command system is not required. However, the stage must be capable of being destroyed by command from the preceding stage and also must contain an automatic flight termination system. All stages that do not contain a command system must contain an automatic flight termination system. The automatic flight termination system destroys the thrust capability of the stage in the event of premature separation or breakoff from the other stages carrying a flight termination system. The termination system is automatically activated by mechanical means when premature separation or breakoff occurs. The manned portion of a space vehicle will not require a destruct system on manned flights. Propulsive systems that are not considered as a stage of a vehicle (retrorockets, escape rockets, payloads, etc.) and which present radiological, toxicological, or explosive hazards will require an automatic flight termination system if they have the capability of violating the launch area or flight safety lines. For liquid-propelled vehicles, flight termination action must cause engine shutdown and fuel dispersion or intermixing, depending upon the nature of the propellants.

The Apollo/Saturn V carries two independent flight termination and propellant dispersion systems in each active booster stage. There is no destruct system associated with the Apollo spacecraft. Figures 3-1 through 3-4 pictorially display the Apollo/Saturn V flight termination/propellant dispersion system.

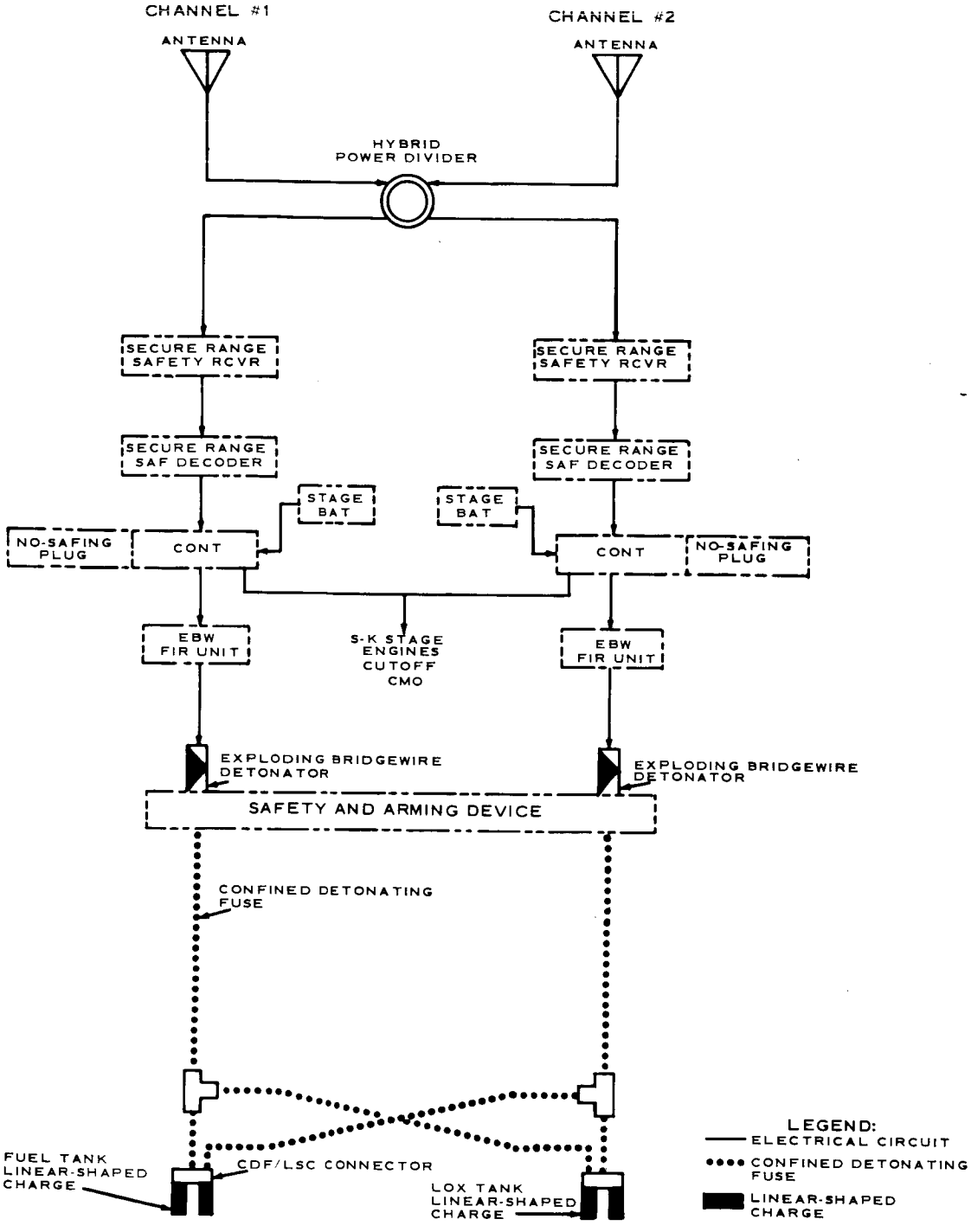

Figure 3-2. S-IC Stage Propellant Dispersion System, Block Diagram

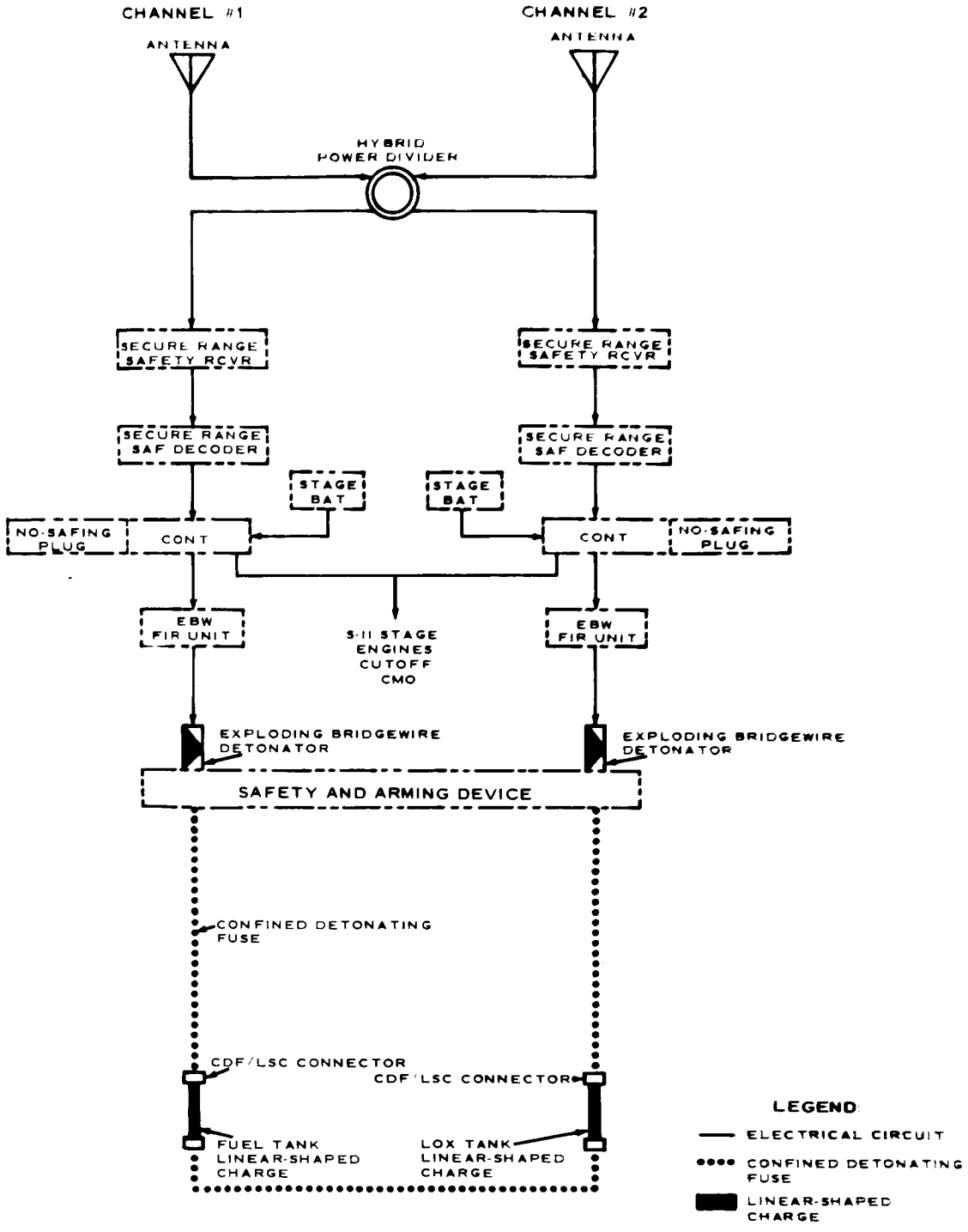

Figure 3-3. S-II Stage Propellant Dispersion System, Block Diagram

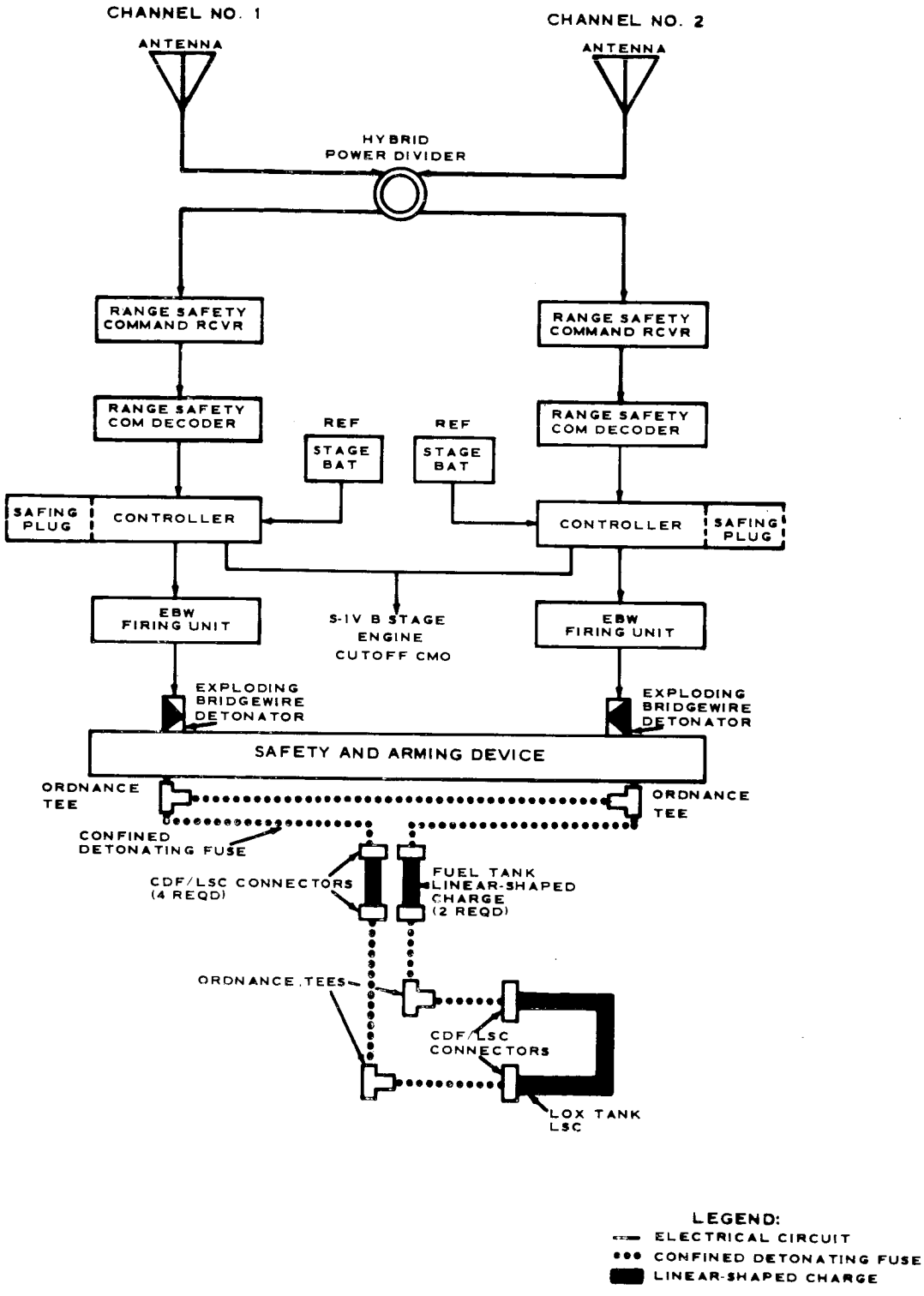

Figure 3-4. S-IVB Stage Propellant Dispersion System, Block Diagram

SECTION IV
FLIGHT SAFETY RESTRICTIONS

4.1 PRECEDENCE

The information contained in this section is disseminated several months before launch and is subject to change at any time. In event of conflict between the Flight Safety Plan and the Apollo Mission Rules published for each launch, the Mission Rules shall be considered the official source for procedures or requirements. (The Mission Rules are constantly subject to revision/updating.)

4.2 WEATHER RESTRICTIONS

4.2.1 CEILING. A minimum ceiling height is imposed on all launches. The height of the ceiling is determined by the time required for the launch area radars to acquire the vehicle after lift-off. If the Cape Kennedy FPS-16 radar and the KSC TPQ-18 radar are committed for "beam intercept" at a specific time after lift-off, the minimum ceiling for AS-501 will be zero. "Beam intercept" requires each radar to be looking at a point in space where the vehicle will be at a specific time after lift-off. The radars acquire and lock onto the vehicle as it passes through these areas. If the radars are not operational, or precipitation between the radar sites and the pads makes "beam intercept" impossible at launch, the minimum ceiling for AS-501 will be 2,000 feet.

4.2.2 VISIBILITY. A minimum visibility limit is imposed on all launches. The visibility limit is usually determined by the vertical wire skyscreen site selected for the launch. If the "beam intercept" method of radar acquisition is used for AS-501, the visibility limit will be zero; otherwise, the visibility will be 5 miles.

4.2.3 WINDS. A wind restriction is usually imposed on the launch if the vehicle remains over Cape Kennedy for any length of time. This restriction prevents pieces of a destructed vehicle from drifting into protected areas. The wind restriction for AS-501 is a 1.25 σ annual wind profile blowing from 65 degrees east of north (figure 4-1) and applicable to an altitude of 30 kilometers. In the event this profile is violated by prevailing wind conditions during countdown, the Range Safety Division performs a computer-simulated flight, terminating thrust and breaking the vehicle into pieces at each interval, with the prevailing winds acting on them to determine if the pieces can fall outside the impact limit lines.

4.3 OPERATIONAL RESTRICTIONS

4.3.1 LAUNCH VEHICLE. A restriction has been placed on the booster concerning engine cutoff resulting from an abort action. An airborne timer will be flown in the booster that will prevent, for a stipulated period of time, booster engine cutoff except by range safety command. For vehicle AS-501, the timer will be set to allow booster engine cutoff by an abort command from T+30 seconds on.

4.3.1.1 Command Receivers. Two operational command receivers on the S-IC, S-II, and S-IVB stages are mandatory for launch.

4.3.2 SPACECRAFT. None

4.3.3 CREW SAFETY. None

4.3.4 OTHER CONSIDERATIONS. Other agreements and/or restrictions that have a bearing on the overall flight safety area are given in the following paragraphs:

a. To allow successful abort of the command module during the S-IC flight, a time delay will be imposed between the commands "cutoff" and "destruct." This interval is governed by a timer on the Range Safety Officer's (RSO) console. For vehicle AS-501, the timer will be set for 2.0 seconds.

b. After normal launch escape system (LES) tower jettison in the early portion of the S-II flight, the RSO will not normally send "destruct" if Range Safety action is taken. If Manual Fuel Cutoff (MFCO) does not establish an Impact Predictor (IP), the RSO will verbally request the Flight Dynamics Officer (FIDO) to send "ABORT" followed by "SPS off." The RSO may elect to send "DESTRUCT" if the above procedures fail to terminate thrust.

c. The RSO will send "MFCO" and will request "SPS off" from Mission Control Center, Houston (MCCH) whenever range safety action is required. The "SPS off reset" command will not be transmitted after any range safety action.

d. The Bermuda RSO will safe the S-IVB destruct system at the first opportunity after the first S-IVB burn.

e. Communications between the Flight Dynamics Officer (MCCH), the Cape Kennedy RSO, and the Bermuda RSO are mandatory.

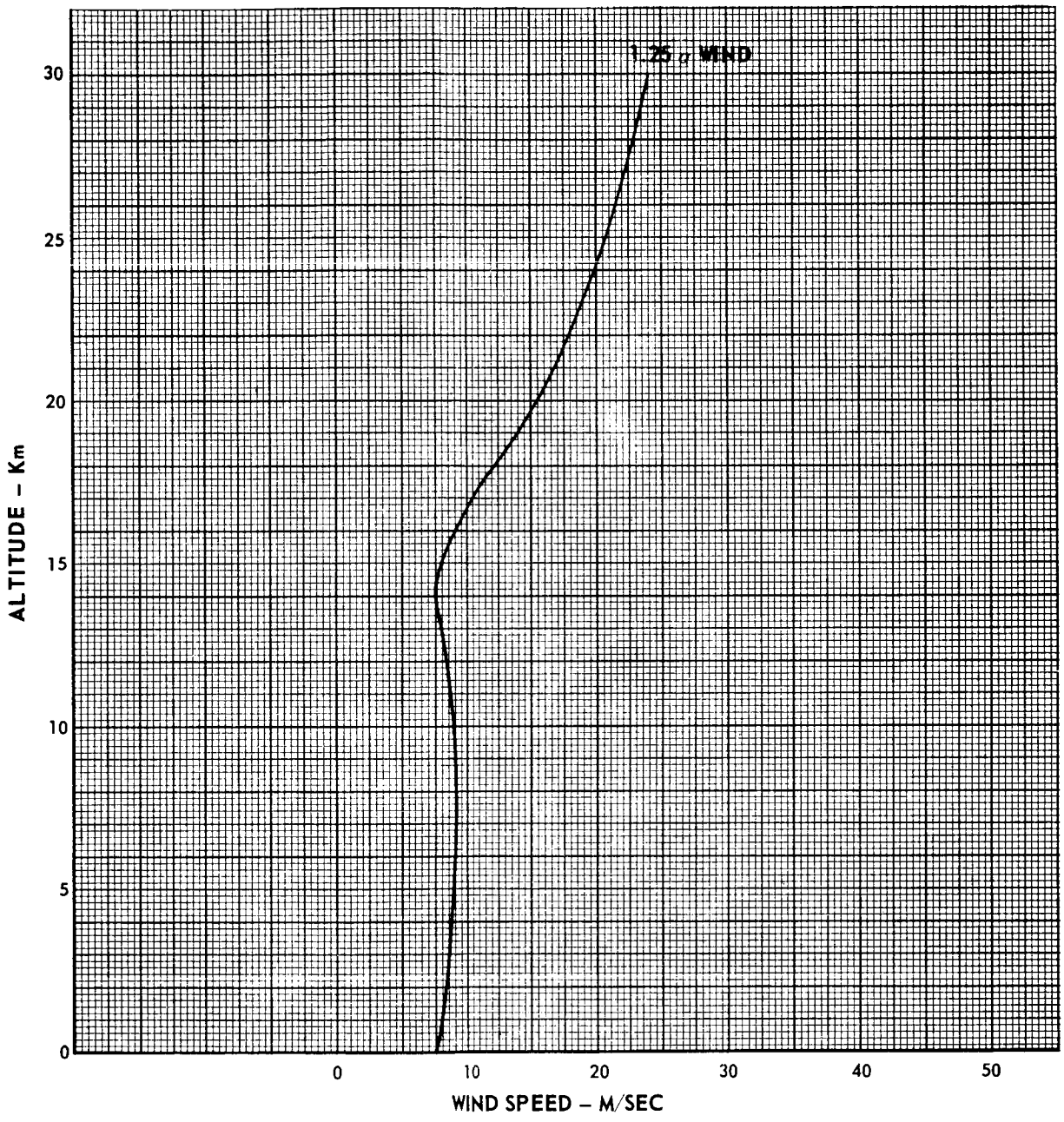

Figure 4-1. 1.25 σ Annual Wind Profile from 65 Degrees Azimuth

SECTION V
FLIGHT SAFETY INSTRUMENTATION

5.1 SAFETY DATA SOURCES

The AFETR requires that at least two different, adequate sources of safety data for each phase of powered flight be operational at launch. An "adequate" source is defined as one which can protect the applicable impact limit line without endangering a normal missile. The RSO will ensure that the adequate data source requirement is met and that those requirements designated "critical" are provided before giving a launch clearence. Those items designated "critical" for AS-501 are:

a. Impact Predictor
b. Bermuda Command Control Transmitter
c. Bermuda FPS-16, Bermuda FPQ-6, Grand Turk FPQ-18 (2 of 3)
d. Spacecraft C-Band Beacon or IU C-Band Beacons

Instrumentation available during S-IC stage powered flight are:

a. High Resolution Trackers (HRT) 1 & 2
b. KSC TPQ-18 C-Band Radar (19.18)
c. Patrick AFB TPQ-18 C-Band Radar (0.18)
d. Glotract Station I
e. Program and Flightline Electronic Sky Screen Equipment (ELSSE)
f. Cape FPS-16 C-Band Radar (1.16)
g. Offset Doppler (ODOP)
h. GBI TPQ-18 C-Band Radar (3.18)

Instrumentation available during S-II stage powered flight are:

a. Cape FPS-16 C-Band Radar (1.16)
b. MILA TPQ-18 C-Band Radar (19.18)
c. Patrick AFB TPQ-18 C-Band Radar (0.18)
d. GBI TPQ-18 C-Band Radar (3.18)
e. Grand Turk TPQ-18 C-Band Radar (7.18)
f. Bermuda FPS-16 C-Band Radar
g. Bermuda FPQ-6 C-Band Radar
h. Flightline ELSSE
i. Glotrack Station I

Instrumentation available during S-IVB stage powered flight are:

a. Grand Turk TPQ-18 C-Band Radar (7.18)
b. Bermuda FPS-16 C-Band Radar
c. Bermuda FPQ-6 C-Band Radar

APPENDIX A
DOCUMENT CATEGORIES

APOLLO/SATURN V
FLIGHT SAFETY PLAN
VEHICLE AS-501

Category	Brief Description of Related Contents	Emphasis Pri.	Emphasis Sec.	See Page(s)
11. Safety	Plan presents flight safety requirements, restrictions, and instrumentation necessary for each Apollo/Saturn V launch.	X		1-1

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